EFFICACY OF AUTOLOGOUS PLATELET RICH PLASMA INJECTION IN PLANTAR FASCIITIS AND TENNIS ELBOW

DISSERTATION SUBMITTED TO

TAMIL NADU DR MGR MEDICAL UNIVERSITY

CHENNAI-INDIA

BY

Dr.PARVEES.CH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE AWARD OF THE DEGREE OF M.S ORTHOPEDICS.

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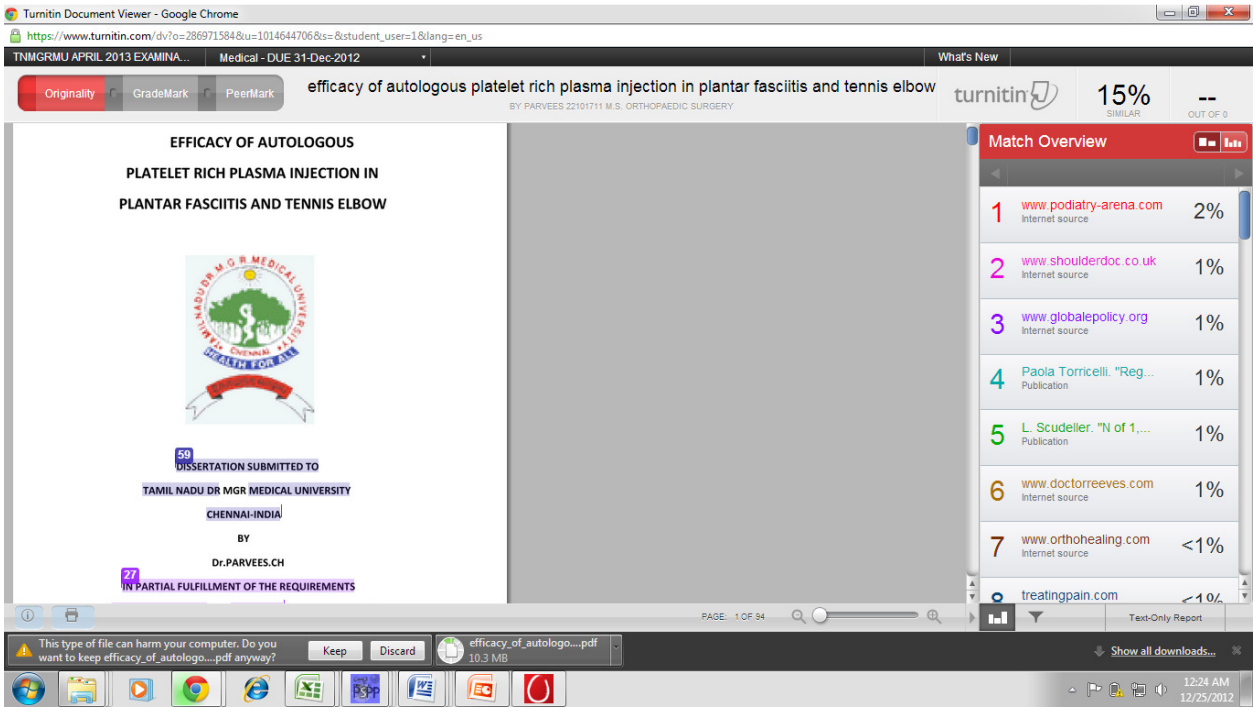
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PROF RAMALINGAM.S

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This is to certify that the dissertation titled **"THE EFFICACY OF AUTOLOGOUS PLATELET RICH PLASMA IN PLANTAR FASCIITIS AND TENNIS ELBOW"** is the original work of **Dr.PARVEES.CH**, done under my guidance and supervision in the department of orthopedic surgery, psg institute of medical science and research, Coimbatore-04 during the period of his post graduate study for MS in orthopedics from 2010 to 2013.

PROF DINAKAR RAI B K

Professor and Head

Department of orthopedic surgery

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INTRODUCTION

Over the past 3 decades, platelet rich plasma has gained increased importance in various medical fields, including orthopedics. Several studies have shown the use the use of platelet rich plasma in management of soft tissue and bony injuries. Recently, platelet plasma has been used for cartilage regeneration, chronic enthasopathies like tennis elbow, plantar fasciitis, and in the field of sports medicine.

Very limited studies are available showing the effect of platelet rich plasma in human tissues. Platelet rich plasma was developed in early 1970s as a part of blood in which platelets are concentrated in plasma. The basic science of platelet rich plasma mainly depends on the growth factors in the alpha-granules. PDGF, TGF-BETA 1, EGF, and VEGF are the growth factors seen in platelet granules. These growth factors have effect on the healing process of many tissues. PGDF is platelet derived growth factor. It is found in alpha granules of platelets. PGDF has mytogenic potential for both mesenchymal and osteoblast cells. PGF is epidermal growth factor which also has mitogenic activity and it will stimulate and regulate collagen synthesis. FGF-fibroblast growth factor, TGF-beta- transforming growth factor beta, IGF-insulin like growth factor, VEGF- vascular endothelial growth

factor and CTGF-connective tissue growth factor have similar potential activities depending upon which tissue they were acting. It is these growth factors which platelet rich plasma a potential substance for regeneration and differentiation of tissues and its use in treatment of various conditions.

The majority of orthopedic applications of platelet rich plasma will fall into 4 categories-

1. Chronic tendenopathies
2. Acute ligamentous injuries
3. Muscle injuries
4. Augmentation of other treatment modalities like bone grafting

The treatment and complete cure from chronic enthasopathies like tennis elbow, plantar fasciitis, has always been ranked among the most difficult and frustrating problem for both patients and treating doctors. Tennis elbow or lateral epicondylitis has been described as a degenerative tendonopathy of extensor carpi radialis brevis muscle. The most common pathogenesis is repetitive micro trauma of muscle from overuse resulting in tendinosis of ECRB with or without involvement of extensor digitorum communis muscle. Various forms of conservative treatments are available for tennis elbow and the

outcome of these treatments varies in patient to patient. Plantar fasciitis is also known as heel tennis, because the plantar fascia is constantly stretched at the attachment over calcaneal tuberosity. Repeated micro trauma makes this disease difficult for conservative treatment. Surgical options like plantar fascia release were practiced but devastating complications will occur since plantar fascia is a supporting structure for maintain the longitudinal arch of the foot.

Platelet rich plasma had a biological healing capacity. Platelet rich plasma helps in healing both tennis elbow and plantar fasciitis and recurrence rate will be low. In this study we used intralesional injection of autologous platelet rich plasma for the treatment of chronic tennis elbow and plantar fasciitis.

AIMS AND OBJECTIVES

1. To study the efficacy of autologous platelet rich plasma in plantar fasciitis and tennis elbow.

2. To compare the outcome of autologous platelet rich plasma injections between plantar fasciitis and tennis elbow patients.

REVIEW OF LITERATURE

PLANTAR FASCIITIS:

Enab Mohamed Selem Ragab et al in his literature on PRP for plantar fasciitis written that plantar fascia function as a supportive structure for longitudinal arch of the foot and it is a thick fibrous structure which originate from calcaneal tuberosity and the run forward towards the metatarsals (1). He also commented that plantar fascia will provide static support along with a dynamic shock absorption function (1).

There are number of causes for heel pain out of which Plantar fasciitis is considered as common in adults (1). Collagen degeneration takes place at the origin of plantar fascia and this is the reason for pain in the heel (1). Plantar fasciitis can be diagnosed based on the history which was more in the morning and by the tenderness on palpation over medial calcaneal tubercle (2). The classic sign is the worst pain that occurs with the few steps in the morning or at the starting of the activity that decreases as they warm up (2).

Plantar fasciitis is considered as a degenerative pathology rather than an inflammatory process. This was supported by histological evidence where

degeneration of plantar fascia along with cells representing chronic inflammation, with multiplication of fibroblasts was noted. The above findings were seen in operative specimens and were reported in Ertgrul Aksahin et al literature on PRP (2).

plantar fasciitis is a self limiting disease which will usually resolve in six to eighteen months (1). This long duration of symptoms will be a frustration for both patients and treating doctors (1). A conservative treatment is preferred in the initial period (2). conservative treatment modalities include changes in daily activities, orthoses, stretching, taping, use of NSAID, extracorporeal shock wave therapy, focused shock wave therapy etc (1, 2, 4).local injections are used secondary for the treatment of resistant plantar fasciitis (2). Enab Mohamed Selem Ragab et al in their literature commented about local steroid injection and said that even though local steroid injection is a popular treatment method for plantar fasciitis , it was found that the actions will be short limited and high recurrence rate has been found (1). From early 1990s, ESWT has been used for treating chronic plantar fasciitis. Results ranged from 48 to 77% (1).

The use of platelet rich plasma in regeneration of tissue is a developing area for clinicians and researchers and has been employed in various fields of surgery including orthopedics (5).

TENNIS ELBOW:

Tennis elbow or lateral epicondylitis is a common problem in office orthopedics and is reported to be 4 times as common in 4^{th} decade of life (7). The term 'epicondylitis' suggests inflammation, although histological analysis found that tissue invariably fails to show inflammation (6). As its term implies, lateral epicondylytis had a high association with tennis, particularly on one handed back strokes. 40% to 50% of tennis players will suffer from this condition during their lifetime (11). Work which uses repeated pronation and supination movements, decreased carrying angle, sudden vigorous supination, weight lifting in extended and supinated forearm are the common predisposing factors (8). Rheumatoid arthritis, arthritic diasthysis, gout and focal sepsis etc suggested in determining the chronicity of the lesion (8).

Pathology of tennis elbow still remains unclear (9). Most popular theory is that the conditions results from repeated contraction of the wrist extensor muscles, mainly the extensor Carpi radialis brevis causes microscopic tears that progress to

the degenerative condition of tendinosis (9). Robert .E. Bunata et al, in their study of anatomic factors for the cause of tennis elbow concluded that the extensor Carpi radialis brevis tendon has a unique location that makes its undersurface vulnerable during elbow motion by contact and abrasion against the lateral edge of the capitellum (9). Knaushaar and Nirschi evaluated surgical specimens collected with failed conservative treatment for tennis elbow using histology and electron microscopy found no evidence to suggest inflammatory process (9). 4 stages of lateral epicondylitis have been described beginning with early inflammatory reaction, followed by angiofibroblastic degeneration, structural failure and ultimately fibrosis or calcification.

Tennis elbow affects approximately 1%-3% of the population (10). The condition is commonly seen in individuals between ages of 35 and 50 years. The dominant arm is most frequently affected (10).

Tennis elbow patients frequently describe pain or burning over the lateral humeral epicondyle that is increased by activities that require resistance to wrist extension (11). Tenderness at the lateral epicondyle and along the common extensor tendon and decreased grip strength is the common palpation findings in

tennis elbow (11). Any test that generates pain by resisted wrist extension is an effective diagnostic tool (11).

Conservative treatment is the initial option for tennis elbow. Typical conservative treatment is rest, non- steroidal anti-inflammatory drugs (NSAIDs), braces, and physical therapy (10, 11, 12, and 13). Corticosteroid injection is considered once the above treatments fail but the effectiveness is now called in question (13). Extracorporeal shock wave, iontophoresis and botolin toxin injection are newer treatment options for tennis elbow (6, 13).

" Platelet rich plasma is a bioactive component of whole blood, which is now being widely tested in different fields of medicine for its possibilities in aiding the regeneration of tissue with poor healing potential" (12). Several studies using platelet rich plasma to promote tendon healing are going worldwide (12). Mishra et al described Positive results of platelet rich plasma injection in patients with tennis elbow (33). Christos Thanasas et al, in their study on platelet rich plasma versus autologous whole blood for chronic tennis elbow supports use of PRP in treating tennis elbow patients (14).

PLATELET RICH PLASMA

Portion of the plasma fraction of autologous blood having a platelet value above baseline is the definition of platelet rich plasma. PRP not only contains more platelets but also the full complement of clotting factors and secretory proteins (15).

Platelets are formed in bone marrow and are the end products of megakaryocytes. No nucleus is present in platelets and cannot replicate. Platelet lifespan is 5-9 days. Platelet plug is formed after tissue injury or surgery where platelets are exposed to damage blood vessels, which makes them direct contact with various extra-cellular proteins (15). Normal platelet counts is between 150000/µL and 350000/µL, and average about 200000/µL in blood (16). "Platelet rich plasma was first promoted by M.ferrari in 1987 as an autologous component after an open heart operation to avoid homologous blood product transfusion"

(18).since then PRP has been safely used in many fields including orthopedics (20).

Platelet is essential for tissue healing (19). Clot formation and platelet activation is the first step in tissue healing (19). The platelet actions in tissue healing are by release of various growth and differentiation factors (19). “These factors are bioactive proteins responsible for attracting macrophages, mesenchymal stem cells, and osteoblasts which not only promotes removal of necrotic tissue, but also enhances tissue regeneration and healing”(20).

The main growth factors contained in alpha granules of platelets are transforming growth factor beta (TGF-beta), vascular endothelial growth factor (VEGF), platelet derived growth factor (PDGF), and endothelial growth factor (EGF)(14). Other growth factors are basic fibroblast growth factor, epidermal growth factor and connective tissue growth factors (19).

TGF-β sources are Platelets, extracellular matrix of bone, cartilage matrix, activated TH1 cells and natural killer cells, macrophages or monocytes and neutrophils. TGF-beta will 1, Stimulates undifferentiated mesenchymal cell proliferation. 2, regulates endothelial, fibroblastic, and osteoblastic mitogenesis. 3, regulates collagen synthesis and collagenase secretion. 4-regulates mitogenic

effects of other growth factors.5-stimulates endothelial chemo taxis and angiogenesis.6-inhibits macrophage and lymphocyte proliferation (19)

Platelet-derived growth factor sources are Platelets, osteoblasts, endothelial cells, macrophages, monocytes, and smooth muscle cells. The actions of PDGF are

-Mitogenetic for mesenchymal cells and osteoblasts

-stimulates chemo taxis and mitogenesis in fibroblast, glial, or smooth muscle cells

-regulates collagenase secretion and collagen synthesis

- stimulates macrophage and neutrophil chemo taxis (19).

Vascular endothelial growth factor are growth factors derived from Platelets and from endothelial cells. The actions are

-Increases angiogenesis and vessel permeability

-stimulates mitogenesis for endothelial cells (19)

Connective tissue growth factor sources are Platelets through endocytosis from extracellular environment in bone marrow. Actions are

- Promotes angiogenesis

-promotes cartilage regeneration

Promotes fibrosis and platelet adhesion (19)

EFFECTS OF PRP IN DIFFERENT TISSUES

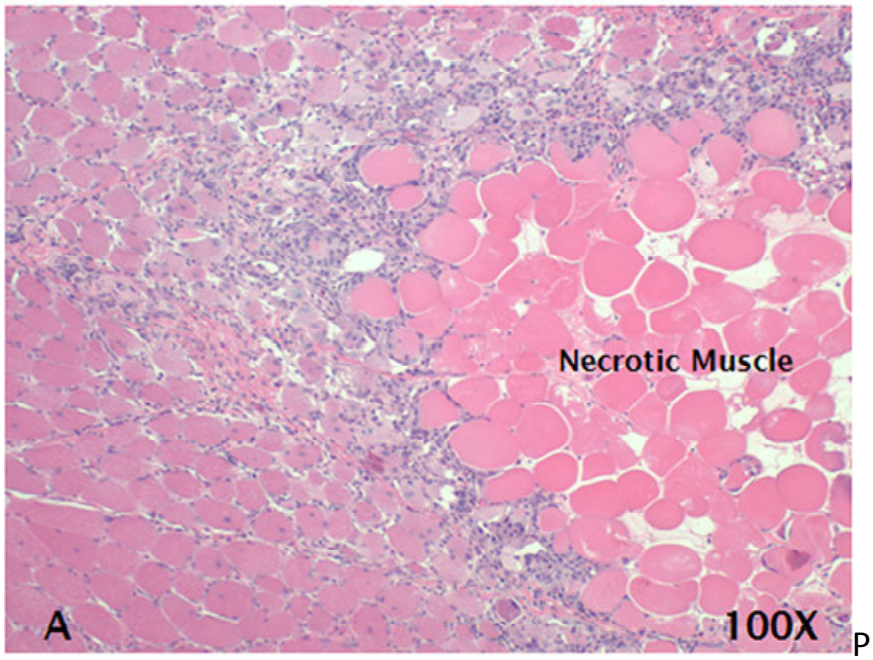
MUSCLE:

Kenneth S Lee in his article stated about cugat et al research on acute muscle injuries with PRP. The assessment was done clinically and ultrasonographicaly on the injured muscle. 50 percent of his patients had good clinical and functional out come(19). N Lindsay Harris in a study on rabbit tissues stated about the microscopic changes in normal muscle tissue following PRP injections.(37). He done studies on 18 rabbits. He injected ½ cc of PRP in to the tissues.

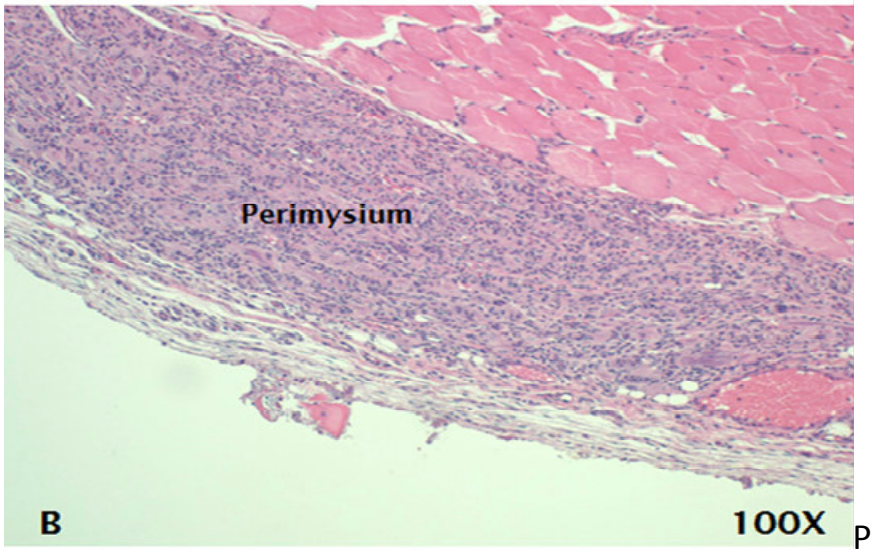
After two-weeks of platelet rich plasma injection he found features suggesting of inflammation. He found inflammatory cells in the tissue. Calcium deposition was seen.

After six weeks of injection he noted the persistence of inflammation. The cells suggesting inflammation was seen. Necrosis of muscle with fibrosis and ca2+ also seen. Ca2+ deposited was found reabsorbed later.

After 12 weeks of injection he did not notice any features suggesting of inflammation.



Picture 1A



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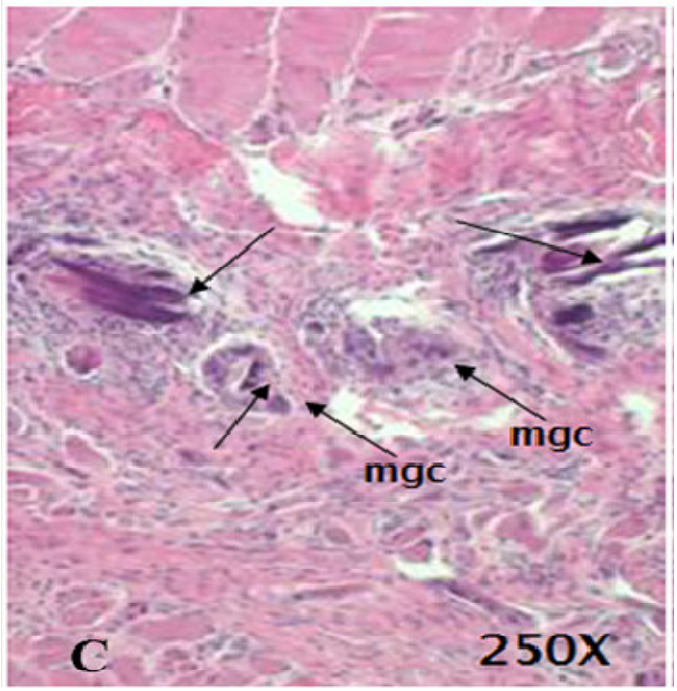


Picture 1C

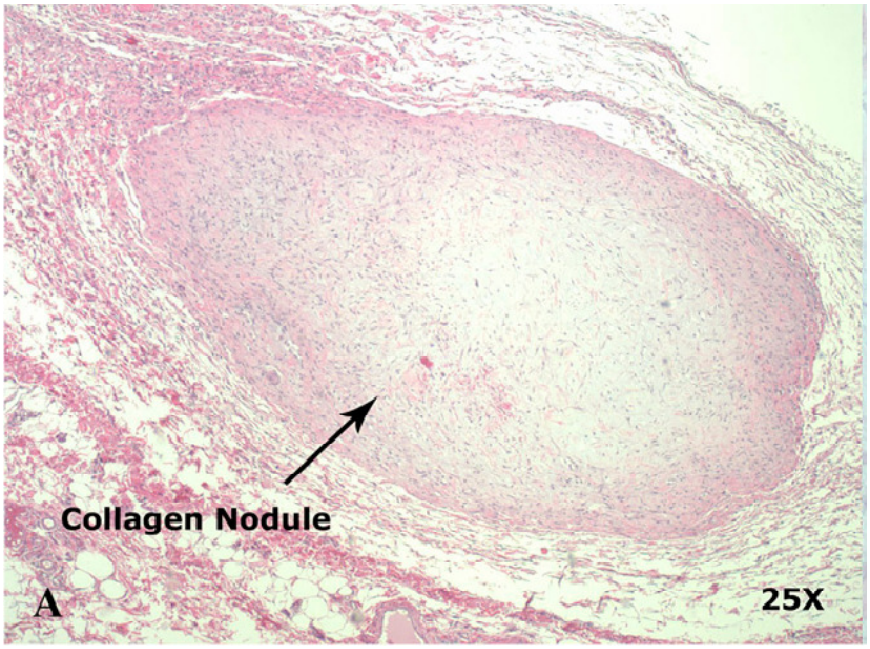
Picture A and B was muscle at 2 weeks and picture C was at 6 weeks. Features of inflammation can be seen in figure A and B, and calcium deposition at figure C which was noted by arrow marks.

SUBCUTANEUS TISSUE:

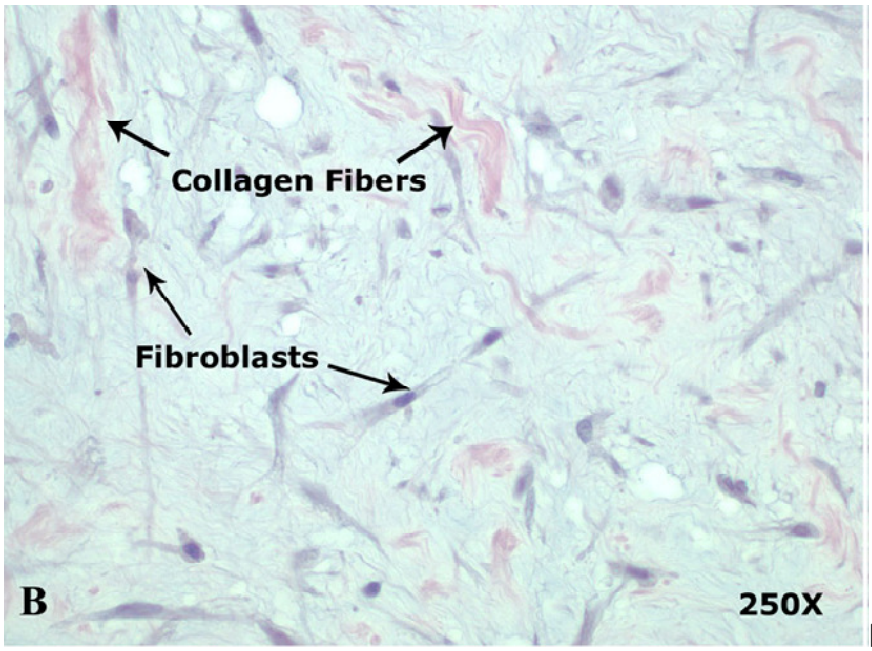
N Lindsay Harris in the above stated study also reported about the effect of PRP on subcutaneous tissues. At two weeks demonstrated Collagen nodules and fibrous tissue was noticed. Fibrous tissue and cells of inflammation replaces the subcutaneous fat.

At six weeks, Micro calcification was noted with cells of chronic inflammation near to it.

At 12 weeks small calcification which was present previously and inflammatory cells was not seen



Picture2 A



Picture 2 B

Picture 2A and 2B was at 12 weeks which shows collagen nodules and collagen fibers.

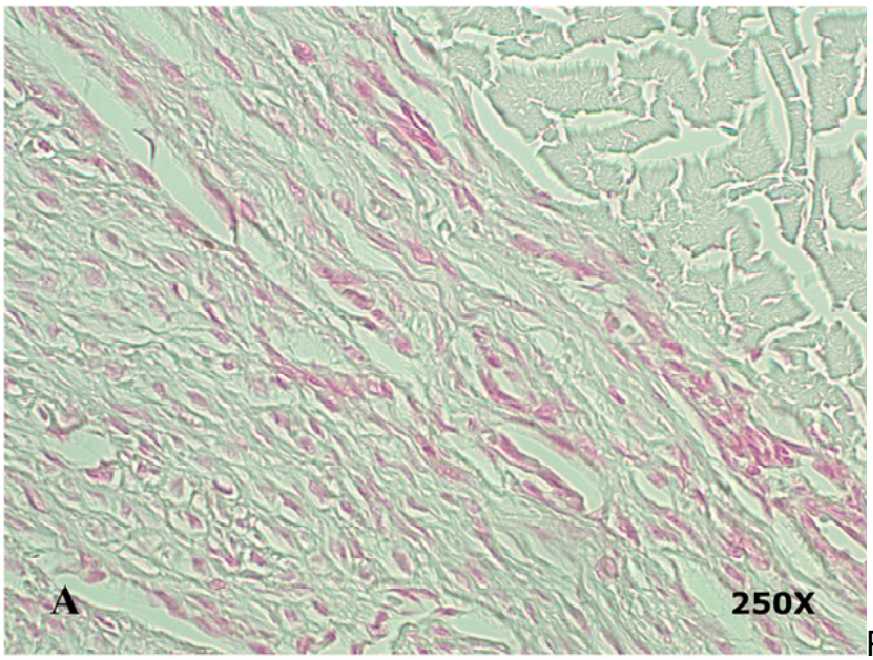
TENDON:

Samir Mehta in his article stated about the use of PRP in tendon injuries and tendinitis (15). Steven Sampson also in his article mentioned about the use of

PRP in tendinopathies (20). There are many articles and studies supporting PRP use in tendon injuries. N Lindsay Harris also stated about effect of PRP on rabbit tendon (37). At 2 weeks thick peritenon and cells of inflammation were noted. Vacuoles and inflammatory cells also seen in tendon tissue. Collagen bundles also seen.

At six weeks, peritenon shows inflammation.

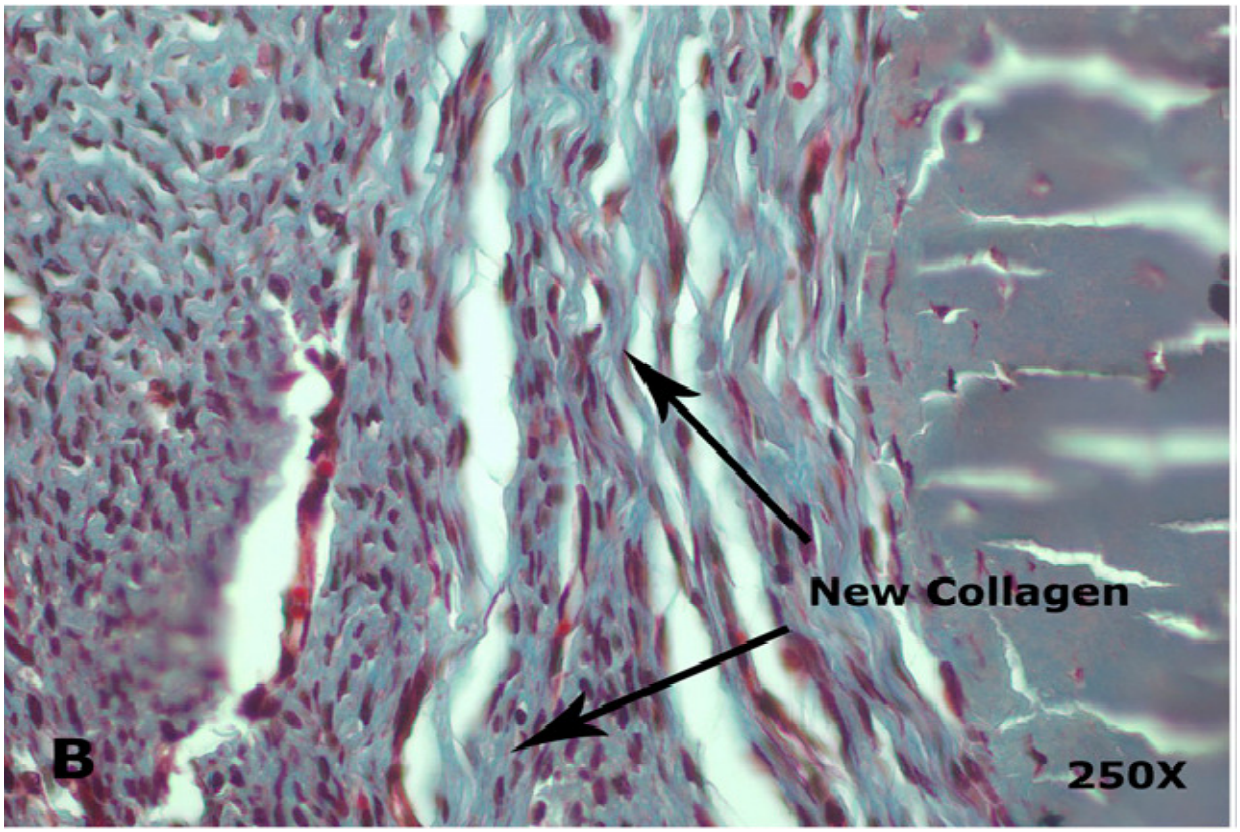
At twelve weeks, inflammation decreased.



Picture 3A

Picture 3A shows no calcification at 2 weeks

Picture 3B shows collagen formation at 2 weeks



picture 3b

LIGAMENTS:

Kenneth S Lee in his review literature mentioned about the studies of foster et al and Frie et al on acute ligament injuries (19). They found patients had accelerated return to their daily activities and sports. Pointing the above studies he stated that PRP will fasten the ligament healing and reduce the instability caused by ligament injuries (19). N Lindsay Harris in his study on normal rabbit tissue found that at two weeks, the tissues were thick which showed inflammation and 6 and 12 weeks showed very minimal inflammation after PRP injection (37).

WOUND HEALING:

Wound healing can be accelerated by the application of platelet rich plasma. The following diagram (diag: 1) explains about the phases of wound healing and the time of platelets action. In PRP platelets are in high concentration which will release the growth factors responsible for wound healing. Various studies had been conducted in animal models and human trials explaining the effect of PRP on wound healing. Samir Mehta in his literature on platelet rich concentrate mentioned about the studies conducted by D R Knighton et al and C Gaino et al (15). 17 out 21 patients had re epithelialization and 78 percent of patients had limb salvage in D R Knighton et al and C Gaino et al studies respectively. PRP was also used

in the donor site for split skin graft. PRP will fasten the epithelialization and reduce the crusting interval (15). Steven Sampson in his literature on the effect of PRP on musculoskeletal injuries stated about the studies of Crovetti et al and McAleer et al (20). Nine out of twenty four and twenty out of twenty four had complete healing of chronic ulcers in Crovetti et al and McAleer et al studies respectively.

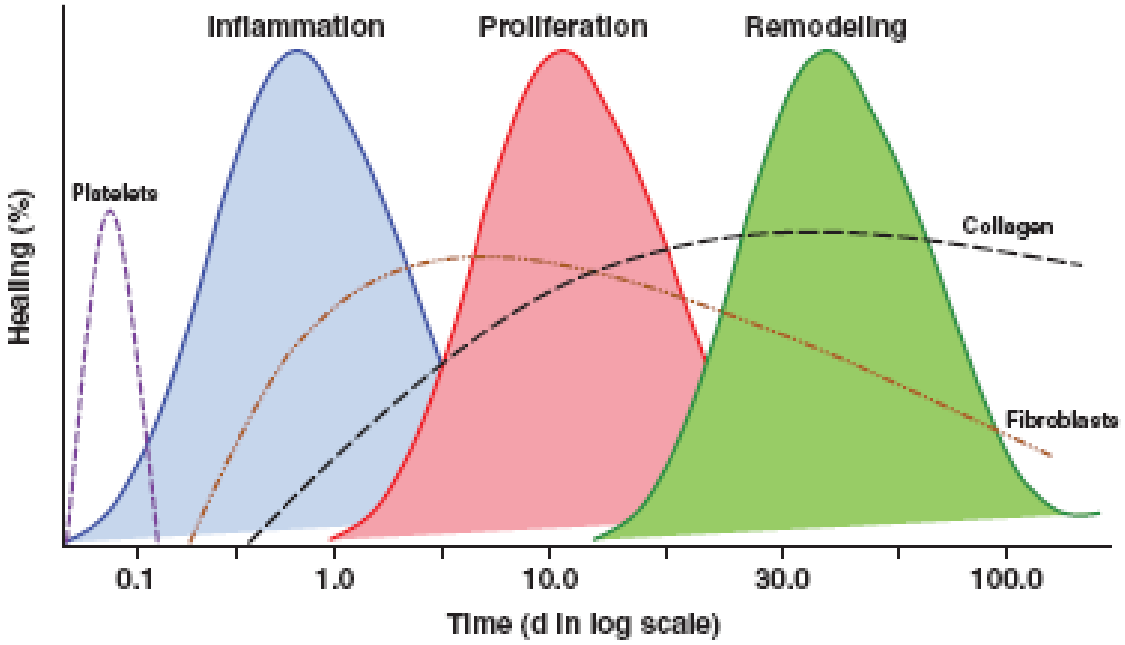


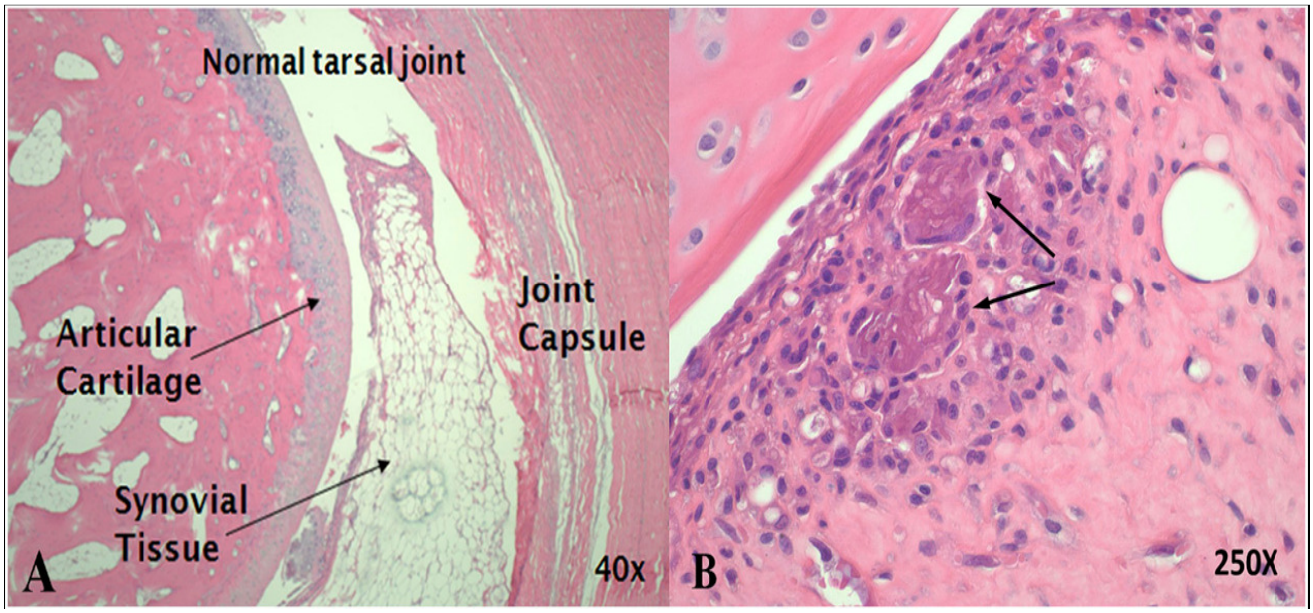
Diagram: 1

BONE:

The effect of platelet rich plasma on bone healing is a topic of debate. Even though some animal studies were not supporting PRP use, most of the studies had positive results (15). Growth factors like PDGF and TGF-β promote bone healing when used in conjunction with bone grafts. J Alsousou et al in their article on application of platelet rich plasma in orthopedics stated about the study of Bielecki et al and found that 13 out of 20 non unions complete union was obtained after PRP application(5). In the same article a study on analyzing the levels of growth factors in fracture hematoma found that no growth factors in non union. In the same article a study of Kitoh et al on distraction osteogenesis was described and found callus formation at 34 to 47 days. Alsousou also commented about use of PRP in diabetic fractures. It was found that growth factors low in diabetic fracture callus. PRP once infiltrated to diabetic fractures will fasten the healing process (5). Samir Mehta in his article on platelet rich concentrate commented about the use of PRP in nonunion (15). He stated that PRP can promote bone healing if adequate bone approximation was present and not in gap nonunion.

JOINT:

N Lindsay Harris in his study on rabbit injected PRP in to normal tarsal joint with a control of normal saline injection. He found features suggestive of synovitis in all with nodules (picture 4a shows normal saline specimen and picture 4b with PRP) in one specimen at two weeks and histological response similar to calcification in subcutaneous tissue at 4 weeks. At six and twelve weeks all the specimens shows normal findings as in normal saline specimen (37).



Picture 4a and 4b

SAFETY OF PLATELET RICH PLASMA

Samir Mehta in his article on platelet rich concentrate mentioned about the safety of autologous concentrate (15). He stated that since it is prepared from the patient's own blood the risk of transmission of communicable disease is nil. He also mentioned about the contra indications of PRP in patients with coagulation diseases and hypersensitivity to the products like bovine thrombin.

Ertugrul aksahin in his study on plantar fasciitis with PRP and steroids concluded that PRP was equally effective as steroid injection and is superior because the complications like fat necrosis can be avoided (2).

Joost C Peerbooms et al in a study on tennis elbow with PRP found no local and systemic complications except for increase of pain during the initial days following PRP injection because of inflammatory process (10).

Bielecki et al in a study to find the antibacterial effect of autologous PRP against methicillin sensitive staph aureus and supports the growth of pseudomonas aeruginosa (38).

PLATELET RICH PLASMA PREPARATION

Different studies used various methods for preparing PRP. Keith S Hetchman et al prepared PRP by a commercially available kit known as cascade autologous platelet system. They collected 9 ml of patient's blood in to a tube containing 1 ml of trisodium citrate and thioxotropic separation gel. The blood collected tube was centrifuged for 6 minutes at 1100g (relative centrifugal force). After initial centrifugation plasma is separated from RBC and WBC. The plasma is transferred in to a tube containing 0.1ml cacl2 (13).

Christos Thanasas et al used a gps 3 system for PRP preparation. 27 to 55 ml of blood was collected with 3-5ml of anticoagulant. They centrifuge the whole blood at 3200rpm for 15 minutes and finally give 3-6ml of PRP (14).

T M Bielecki et al in an in vitro study prepared PRP using a gps 1 system where 54 ml of whole blood was collected in a tube containing 6 ml of citrate solution. The whole blood was centrifuged for 12 minutes at 3200 rpm and finally gives 6 ml of PRP (38).

Augustus D Mazzocca et al used 3 different types of PRP preparation methods. An arthrex ACP syringe is used in one method and gps 3 platelet concentrating system in other method. Both the systems used only single spin. In the third type they used a double spin method with 1st centrifugation at 1500 rpm and second centrifugation at 6300 rpm (23).

Samir Mehta in his article on platelet rich concentrate described about a non centrifugation method of PRP preparation using assay device. 60 ml of anticoagulated whole blood is mixed with priming solution and allowed to flow through a filter device. After back flushing using sterile solution PRP was obtained. The PRP so obtained are similar to concentration which was obtained by centrifugation method and the process is 40 percent faster than the centrifugation method (15).

PRP ACTIVATION:

Activation of PRP releases growth factors rapidly, with 90% released in 10 minutes. Most growth factors have short half lives and effectiveness will be more if PRP are activated. PRP can be activated exogenously before injection by thrombin, cacl2 and endogenously by mechanical trauma. Once PRP is activated a fibrin network forms, solidify plasma and creates a fibrin clot or membrane. The fibrin network will be an unstable network if PRP is activated too strongly. A physiological manner of activation forms a more stable tetra molecular network which enhances enmeshment of cells and growth factors (18).

Most PRP kits available commercially do not activate PRP. To avoid unintentional activation by injuring cells, large bore needles are used, to draw blood and reinjection. Similarly braking systems of centrifuge machines also have a role in unintentional activation.

Stefano Gumino et al used autologous thrombin for platelet activation (34). Juan Ramon Valenti Nin et al used 10% cacl2 for activation of platelets intra operatively (32). Kenneth S Lee et al described that needle prick at the time of injection will induce bleeding which will provide the clotting factor thrombin need for activating platelets(19).

ANIMAL STUDIES

1

Jason L Dragoo et al in a study on rabbit evaluated the inflammatory effect of leukocyte-rich PRP and leukocyte-poor PRP after intratendinous injection (30). 17 New Zealand White rabbits used for testing. Healthy patellar tendons were used. 2 mL autologous whole blood in one patellar tendon, and the other with 2 mL sterile saline was injected in control animals. Seven tendons with whole blood and 7 tendons with saline were injected. In the study rabbits, one tendon with 2 mL LR-PRP, the other with 2 mL LP-PRP was injected. Ten tendons with LR-PRP and 10 tendons with LP-PRP were injected. After injection Animals euthanized at 5 or 14 days. Tendons were stained by hematoxylin and eosin and scored for WBCs, macrophages and lymphocytes, PMNs, vascularity and fibrosis. They concluded that leukocyte-rich PRP causes greater acute inflammatory response at 5 days. There was no difference in the inflammatory response and cellularity at 14 days regardless of type of injection (30).

2

Torricelli P et al published an article with the aim to evaluate the efficacy of administrating a combination of autologous PRP and bone marrow mononucleated cells (BMMNCs) by conducting study in 13 competition horses affected by overuse injuries (suspensory ligament desmopathy and superficial flexor tendinopathy)(25) . After USG localization, the autologous BMMNC and PRP injected directly into the lesion. BMMNC, platelet count and growth factors in PRP were measured. They found that a marked improvement in their degree of lameness and 84.6% return to competition. Among the factors, the platelet concentration predicted the healing time: significantly faster recovery (p 0.049) observed with cases of PRP > 750 *10(3)/µl platelets (25).

3

Kaux J F et al did a study to find whether PRP will accelerate the healing process of ' Achilles tendons after surgical induced lesion in rats (26). Surgically 5 mm defect was induced in Achilles tendon of 90 rats. Two groups of 45: (A) control (no treatment) and (B) PRP treatment were formed. Group B got PRP injection in situ after the surgery. Rats of both groups placed in cages without immobilization. 10 traumatized Achilles tendons of each group were dissected after 5, 15 and 30 days. Tendons were also submitted for a tensile test up to rupture. They found

that the force necessary for inducing rupture during tensile test was more for tendons which had a PRP injection than the control group(26)

4

Jason W hammond et al done a study in rats to identify the use of autologous PRP in treatment of muscle strain injuries (27). Tibialis anterior muscles of rats were injured by single or multiple lengthening contractions which causes a significant injury in vivo. Tibialis anterior was injected either with PRP, platelet poor plasma or without any treatment. They concluded that local delivery of platelet rich plasma decreases the recovery time for muscle injuries (27).

5

Hans T M et al done a placebo controlled trial to test the hypothesis that “a single intra-tendinous PRP treatment would enhance the quality of tendon repair” (28). 6 horses, well-defined, standardized tendon lesions were surgically created in the Superficial Flexor tendons in both front limbs; one was treated with PRP and the other with saline after 1 week of surgery. Repair processes were monitored regularly by a novel method for computerized ultrasonographic tissue characterization (UTC) and by Doppler flowmetry. After 24 weeks the tendons were taken for biomechanical,biochemical and histological evaluations. They

found that PRP affects all phases of repair. Less inflammation (first 2 weeks post-treatment), better early fibrillogenesis (starting from 1 till 7 weeks), advanced organization and remodeling (starting from 11 weeks) were noted. On Doppler neovascularization was increased during all phases in PRP group (28).

6

Arguelles D et al in a study to find the use of PRP on soft tissue injuries (29).he conducted the study in horses. 7 horses were selected for the study. They had injury to tendons and ligaments. They gave PRP thrice with 2 weeks gap. They followed up using USG. They assessed after 2 months of treatment. After 1 year of treatment they also checked the status. Before injection they checked the counts of cells in PRP. All the horses treated with PRP injection participated in competition following the recovery. They found the performance was good after the treatment with PRP (29).

HUMAN STUDIES:

1 Taco gosens et al done a study on patients who had chronic tennis elbow (31). They used 2 treatment methods. They used PRP and steroid injections for treatment. A total of 100 patients were included in that study. Out of 100 patients a computer allocated the patients in to 2 groups. First group had 51 patients and second group had 49 patients. First group was treated with PRP and second group was treated with steroid injection. Before and after the injection they used VAS and DASH scoring system for the assessment of patients condition. The follow up period was 2 years from the time of injection. The results they got showed good improvement in patients treated with PRP than steroid group. They concluded that PRP had good effect in treating tennis elbow (31).

2

Suzan de jonge et al done a study with the aim of finding the use of PRP in treating tendinopathy (32). They selected achilis tendinopathy for their study. The criteria they used was tendinopathy at 2-7 cm from insertion of tendon. They selected 44 patients for their study. Pre injection and post injection assessed with USG and they used one scoring system. The scoring system they used was VISA. They had a control group whom they given only saline injection.

Both the group had tendinopathy and both group undergone severe exercises. After the study period they analyzed the results and found the patients in both group improved by the scoring system and by USG evidence. 59% of patients improved in both group and they cannot make any difference in the groups (32).

3

Allan mishra et al done a study to identify the effect on chronic severe elbow tendinitis using buffered platelet-rich plasma (33). 140 patients with epicondylar elbow pain were included in this study. All patients were given a physical therapy which was a standardized protocol and other non operative treatments. 20 patients had pain persistently for a mean of 15 months in spite of these treatments. Surgery was considered for all patients. This cohort of patients who had failed conservative treatment was then given either a single platelet-rich plasma or bupivacaine injection. They found those 8 weeks after the injection, the platelet-rich plasma group noted 60% improvement in their VAP scores and 16% improved in control group. 60 percent (3 of 5) of the control subjects withdrew or sought various treatments after the 8-week, preventing further direct analysis. At 6 months, the patients who got PRP treatment had 81% improvement in visual analog pain scores. At final follow-up of 12-38 months, the PRP patients had 93% reduction in pain compared with the before treatment (33).

4

Louay fallouh et al done a study aiming to find the treatment for acl injuries with PRP clots (21). They did study using the remnants of ACL those who underwent reconstruction. Autologous blood also collected from the patients. They created PRP clots and poor clots and they cultured the remnants of ligament in that. They also measured the growth factors in each and found that factors are high in PRP. They found collagen types grown in the culture. The culture medium which used PRP found high collagen 3 than the other mediums. Type 1 collagen was somewhat similar in the groups (21).

5

Stafano gumina et al done a study to evaluate “the clinical and magnetic resonance imaging (MRI) results of arthroscopic rotator cuff repair with and without the use of platelet-leukocyte membrane in patients with a large posterio superior rotator cuff tear, found that rotator cuff re tears were observed only in the group of patients in whom the membrane had not been used, and a thin but intact tendon was observed more frequently in this group” (34). They used 80 full thickness tear of rotator cuff patients and all the patients under gone arthroscopic repair and randomly used platelet rich membrane for the treatment. They used

membrane in each anchor in whom undergone treatment with membrane. “Outcomes were the difference between the preoperative and postoperative Constant scores and the repair integrity assessed by MRI according to the Sugaya classification”. Another outcome they used was preoperative and postoperative Simple Shoulder Test scores. The results showed that “only significant differences between the two groups involved the patient age and the preoperative and postoperative Constant scores the differences in the Constant score were due to differences in the shoulder pain sub score” (34).

6

Ehab Mohamed selem ragab et al done a study “to find the effectiveness of PRP treatment for chronic plantar fasciitis” (1). The patient population they selected was 25 and they given injection for the 25 patients with PRP. The assessment was done using VAS and USG thickness of the fascia. They followed up for 10 months. They found that “by the use of a visual analog pain scale, the average pre injection pain in patients of was 9.1 (range 8–10). Prior to injection, 72 % of patients had severe limitation of activities, and 28 % of patients had moderate limitation of activities. Average post-injection pain decreased to 1.6. Twenty-two patients (88 %) were completely satisfied, two patients (8 %) were satisfied with

reservations, and one patient (4 %) was unsatisfied with using the visual analog scale" (1).

7

Ertugral aksahin et al did a study in plantar fasciitis patients by comparing the effect of platelet rich plasma and steroid injection (2). 60 patients selected by them had a conservative management for 3 months. 30 patients were given PRP injection and other 30 given steroid injection. They evaluated the Patients using the "modified criteria of the Roles and Maudsley scores and visual analog scale before injection and 3 weeks and 6 months following injection". They found that the " the mean pain score before the injection was 6.2 and 7.33 in steroid and platelet rich plasma group respectively which was reduced to 3.4 and 3.93 in each group after 6 months" . They concluded that "by the assessment of pain by visual score and roles and mausey score there were no significant difference in steroid and PRP group and both had significant decrease of pain at 6 months" (2).

8

Leon creaney et al in a study compared the "effect of PRP with autologous blood injection in elbow tendinopathy" (35). They selected 150 tennis elbow patients and treated 80 with PRP and the remaining 70 with whole blood. They assessed the patients using PRTEE score. At 6 months the authors observed a "66% success

rate in the PRP group versus 72% in the ABI group, p=NS. There was a higher rate of conversion to surgery in the ABI group (20%) versus the PRP Group (10%)".They concluded that the "patients who are resistant to first-line Physical therapies such as eccentric loading, ABI or PRP injections are useful second-line therapies to improve clinical outcomes" (35).

9

Luigia scuddler et al done a study on bilateral epicondylitis comparing the effect between platelet rich lysate and wait and watch protocol. Outcome measures were by Visual analogue scale for pain on elbow Extension and resisted wrist extension. They found that Over six months' follow-up, the patient experienced bilateral improvement in pain, but higher in the treated arm, with a drop in visual analogue scale for pain from 28 to 4 for right (control) arm (drop of 24 points) and from 67 to 10.5 for left (treated) arm (drop of 56.5 points).

10

Lopez gavito E et al did a "Prospective, analytical study". They selected patients with tennis elbow and plantar fasciitis and assessed usinf AOFAS scale along with VAS scale. The followed up for 2, 4, 8, and 12 months following PRP injection. They found that "a sample consisting of 10 patients (12 feet) that met the diagnostic and inclusion criteria was obtained. Mean age at the time of

presentation was 43 years (range 23-56), with females being predominant (70%) and 50% laterality for the right and left feet". They also found that "the initial AOFAS score was 39 (range 28-68) and the VAS score was 9 (range 7-10). By week 16 the AOFAS score had increased to 97 (range 88-99) and the VAS score was 2 (range 1-4). All patients resumed independent gait". They concluded that PRP is a safe and alternative mode of treatment in tendinopathies and plantar fasciitis (36).

MATERIALS AND METHODS:

This is a prospective trial involving the patients in the department of orthopedics, PSGIMSR from April 2011 to April 2012. Prior consent was obtained from ethics committee for research in human beings before the study.

A total of 70 patients were included in this study. Out of 70 patients 25 patients had tennis elbow and 45 patients had plantar fasciitis. All the patients were selected based on the inclusion and exclusion criteria described. All the patients underwent same method of treatment. All the patients were assessed based on the numerical pain scoring system which will be described.

INCLUSION CRITERIA

1. Patients with clinically diagnosed tennis elbow or plantar fasciitis
2. Patients should have minimum three months duration of symptoms
3. Patients should underwent conservative treatment for a minimum period of three months
4. Patients should have pain score greater than seven at the time of PRP injection.
5. Patients should not had a local steroid injection in last 2 months
6. Both sexes- males and female
7. Age- 18 years and above

EXCLUSION CRITERIA

1. Less than 3 month duration of tennis elbow and plantar fasciitis
2. Pain score less than seven
3. Patients without any trial of conservative treatment
4. Recent local steroid injection.
5. Infection or ulcer at the injection site
6. Rheumatoid arthritis
7. Sero negative spondylo arthritis
8. Pregnant ladies
9. Patients younger than 18 years
10. Suspicion of diagnosis

INFORMED CONSENT:

Informed consent was obtained from all the patients after explaining the disease condition and treatment with PRP injection in their local language. All the patients were informed about the study. All the patients agreed for the procedure and to participate in the study. All the patients and their nearest relative signed in the consent form.

CLINICAL DIAGNOSIS:

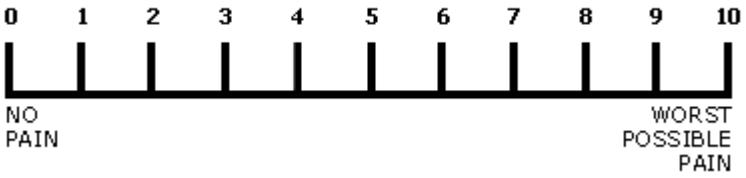
Diagnosis of tennis elbow was made when patient had pain in the lateral aspect of elbow joint. The pain would aggravate on wrist dorsiflexion. On examination the patient would have localized tenderness over lateral epicondyle.

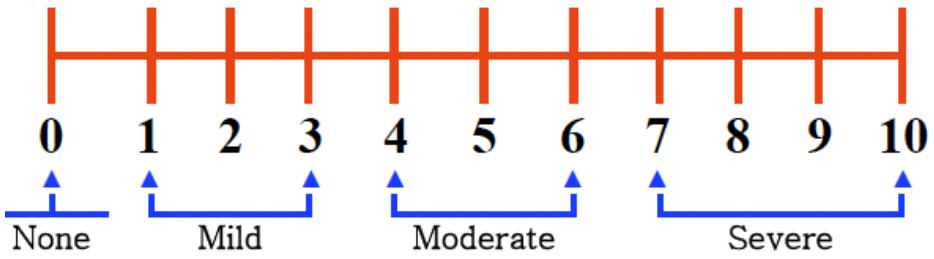
Diagnosis of plantar fasciitis was made when patient had heel pain. The pain was worse in the morning. Patient had localized tenderness over the insertion of plantar fascia over the calcaneum.

NUMERICAL PAIN SCORE

Numerical pain score is a subjective assessment of pain, where the patient rates the intensity of the pain perceived. Score Zero refers to no pain. Score 10 refers to the worst pain possible.

On the basis of numerical pain score, intensity of pain was divided in to mild, moderate and severe. Score zero to three was taken as mild, four to six as moderate and seven to ten as severe pain.





PREPARATION OF PRP:

Platelet rich plasma was prepared using double spin centrifugation method of Augustus D et al(25).20 ml of venous blood is drawn from cubital vein. The blood is immediately transferred into six 2.7ml vaccutainers prefilled with acid citrate dextrose. 2.7 ml Acid citrate dextrose containing vaccutainers are readily available in hospital. All the containers are filled till the markings on the vaccutainers. The vaccutainers are then placed in the slot available in the centrifugation machine in such a way that they are counter balanced. The initial centrifuge was done at 1500 rotations per minute for three minutes. This separates the blood into two layers. RBC rich at the bottom and plasma along with the platelets are at the top (figure 1). The top layer is then transferred to fresh vaccutainers using a long 18 G needle and syringe. The vaccutainers are now again centrifuged at 2500 rotations per minute for three minutes. This separates the column of plasma to platelet rich at the bottom and platelet poor at the top. Using a long 18 G the top half column which is platelet poor is discarded. The platelet rich plasma at the bottom is now collected from the vaccutainers and is now ready for use.

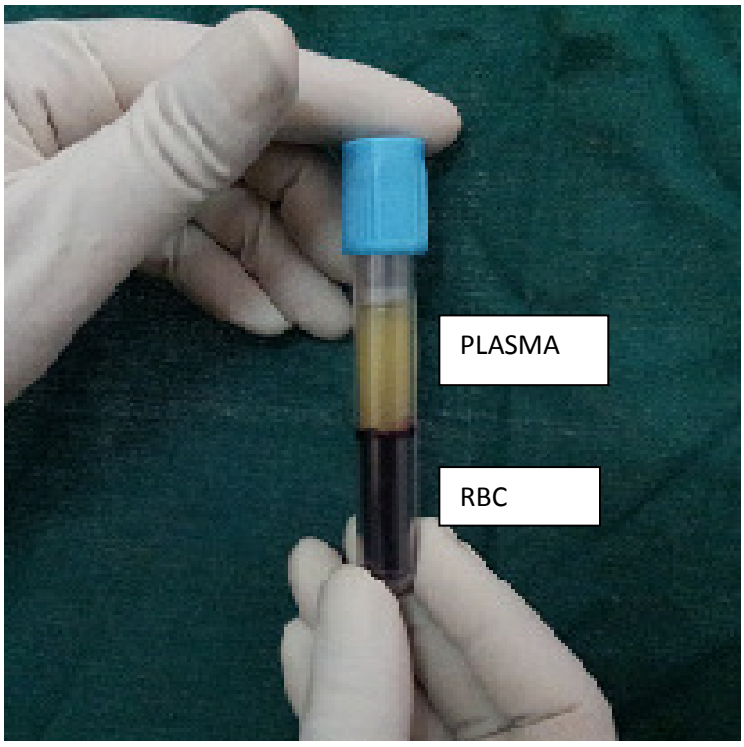
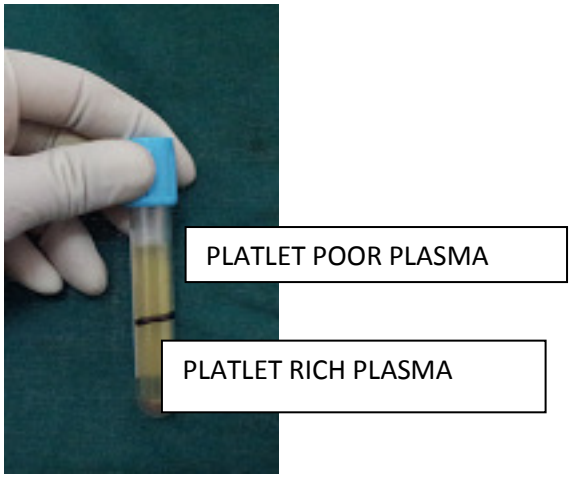


Figure 1

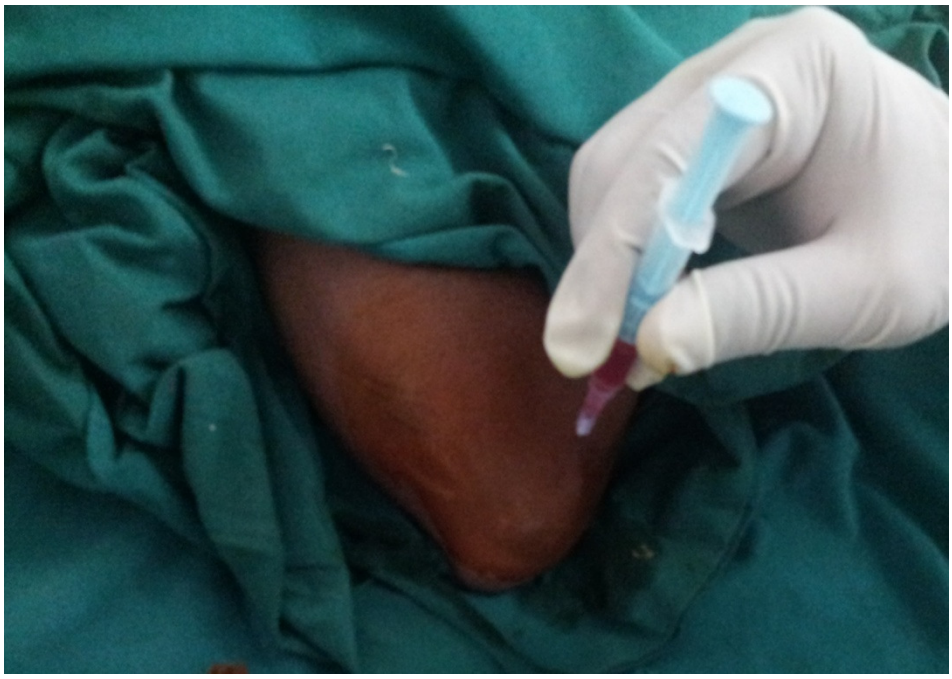
Figure 2



After the preparation of PRP, the cell counts in the sample is assessed using the ---------- machine. The platelet count in the sample ranged from 2.1 to 5.9 lakhs.

TECHNIQUE OF INFILTRATION:

Most tender point was palpated and marked using a skin (figure 3) marker and area was prepared for injection. Under aseptic precaution using a 21 and 1 1/2 inch needle, 1ml PRP is injected initially over the maximum tender point and needle is partially withdrawn and multiple punctures are made in the surrounding tissue (peppering technique). The remaining 1 ml of platelet rich plasma was injected in surrounding tissue.



Injecting PRP in tennis elbow patient

Injecting PRP in plantar fasciitis patients

PLATELET ACTIVATION:

According to Kenneth s lee et al needling of surrounding tissue will activate the platelets by the release of thrombin from the fresh bleeding. We used this technique for platelet activation (19).

FOLLOW UP:

Patients were followed up for 6 months. A telephonic follow up was done at second day after injection to find out any adverse reactions. Follow ups was done at 1,2,4,6 months. Patients were assessed subjectively using the numerical pain score.

RESULTS AND ANALYSIS:

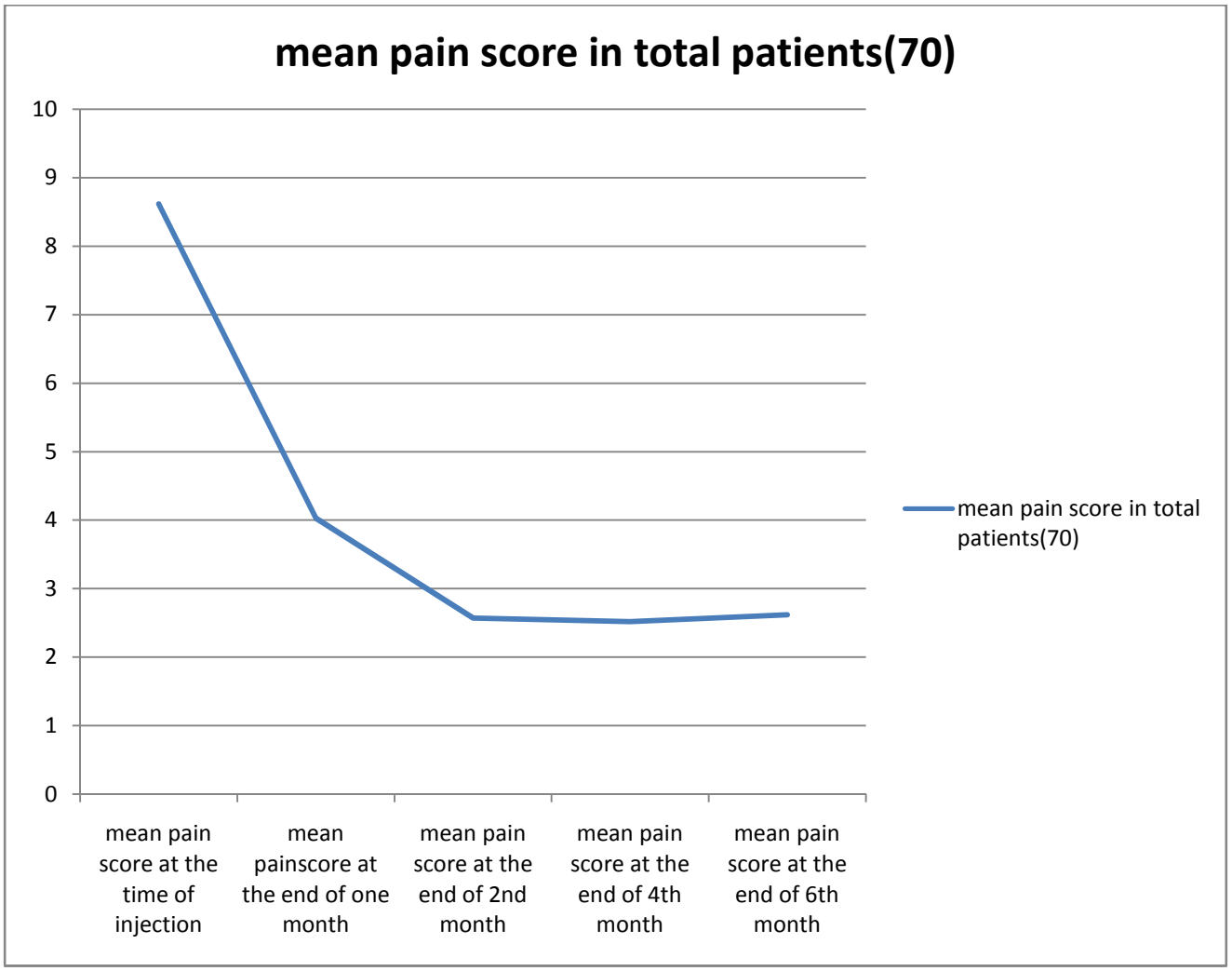
Patients were analyzed for pain relief subjectively at 1, 2, 4 and 6 months. The results are given below.

MEAN PAIN SCORE:

Pain score was assessed at the time of injection. The mean pain score of all the patients was 8.614. The mean pain score at 1,2,4,6 months was 4.028, 2.57, 2.52 and 2.62 respectively. When individually analyzed mean pain score for plantar fasciitis at 0, 1,2,4,6 months was 8.68, 3.68, 2.155, 2, 2.13 respectively. similarly mean pain score for tennis elbow at 0,1,2,4,6 months was 8,08,4.36,3.56,3.48,3.6 respectively. From the above data it can be inferred that patient get maximum relief of symptoms at two months and is sustained till at least 6 months (chart no 1).

PATIENTS	MEAN PAIN SCORE AT TIME OF INJECTION	MEAN PAIN SCORE AT 1ST MONTH	MEAN PAIN SCORE AT 2ND MONTH	MEAN PAIN SCORE AT 4TH MONTH	MEAN PAIN SCORE AT 6TH MONTH
TOTAL (70)	**8.614**	**4.028**	**2.57**	**2.52**	**2.62**
PLANTAR FASCIITIS (45)	**8.68**	**3.68**	**2.155**	**2.00**	**2.13**
TENNIS ELBOW (25)	**8.08**	**4.36**	**3.56**	**3.48**	**3.60**

Chart no 1. Mean pain score



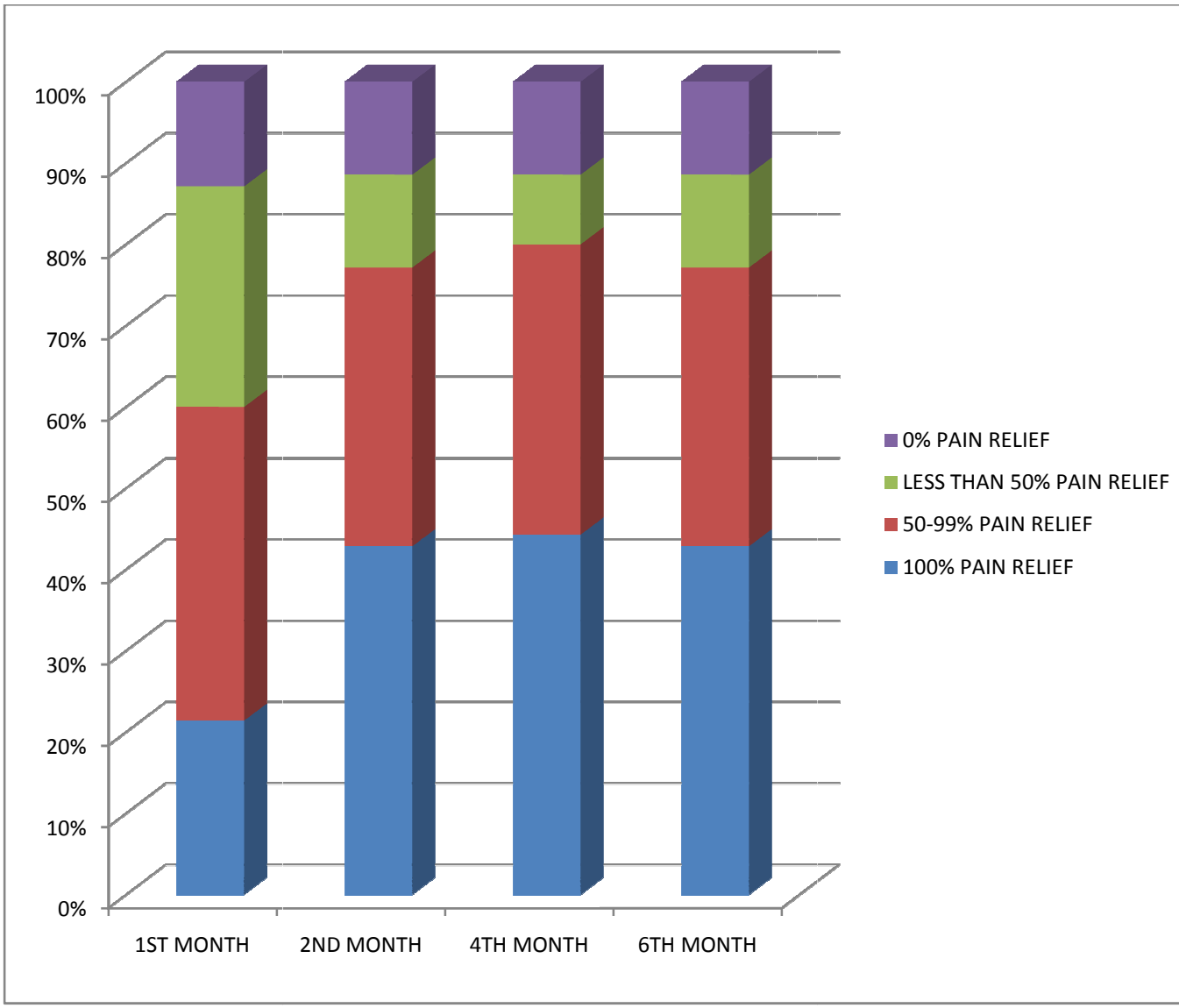
Graph no 1: mean pain score

PERCENTAGE REDUCTION OF PAIN:

Patients were analyzed for percentage reduction of pain. Percentage reduction of pain is obtained by calculating the percentage of the difference of pain score at every follow up from initial pain score at the time of injection. Out of the 70 patients 15 patients had 100 percent pain relief at one month and 30 patients at two months. This was sustained till the end of study. One patient had recurrence at four months. However 77 percentages of patients (54 out of the 70) had significant relief of pain (more than 50 percentage pain relief) at the end of two months, which was sustained till the end of study. 11 percentage (11 out of 70) patients did not benefit at all after the injection. 2 patients out of 70 had recurrence of pain in spite of early relief (chart no 2).

	100% PAIN RELIEF	50-99% PAIN RELIEF	LESS THAN 50% PAIN RELIEF	0% PAIN RELIEF
1ST MONTH FOLLOW UP	15(21.42%)	27(38.57%)	19(27.14%)	9(12.85%)
2ND MONTH FOLLOW UP	30(42.86%)	24(34.286%)	8(11.43%)	8(11.43%)
4TH MONTH FOLLOW UP	31(44.286%)	25(35.71%)	6(8.57%)	8(11.43%)
6TH MONTH FOLLOW UP	30(42.86%)	24(34.286%)	8(11.43%)	8(11.43%)

Chart no- 2 percentage reduction of pain in total patients

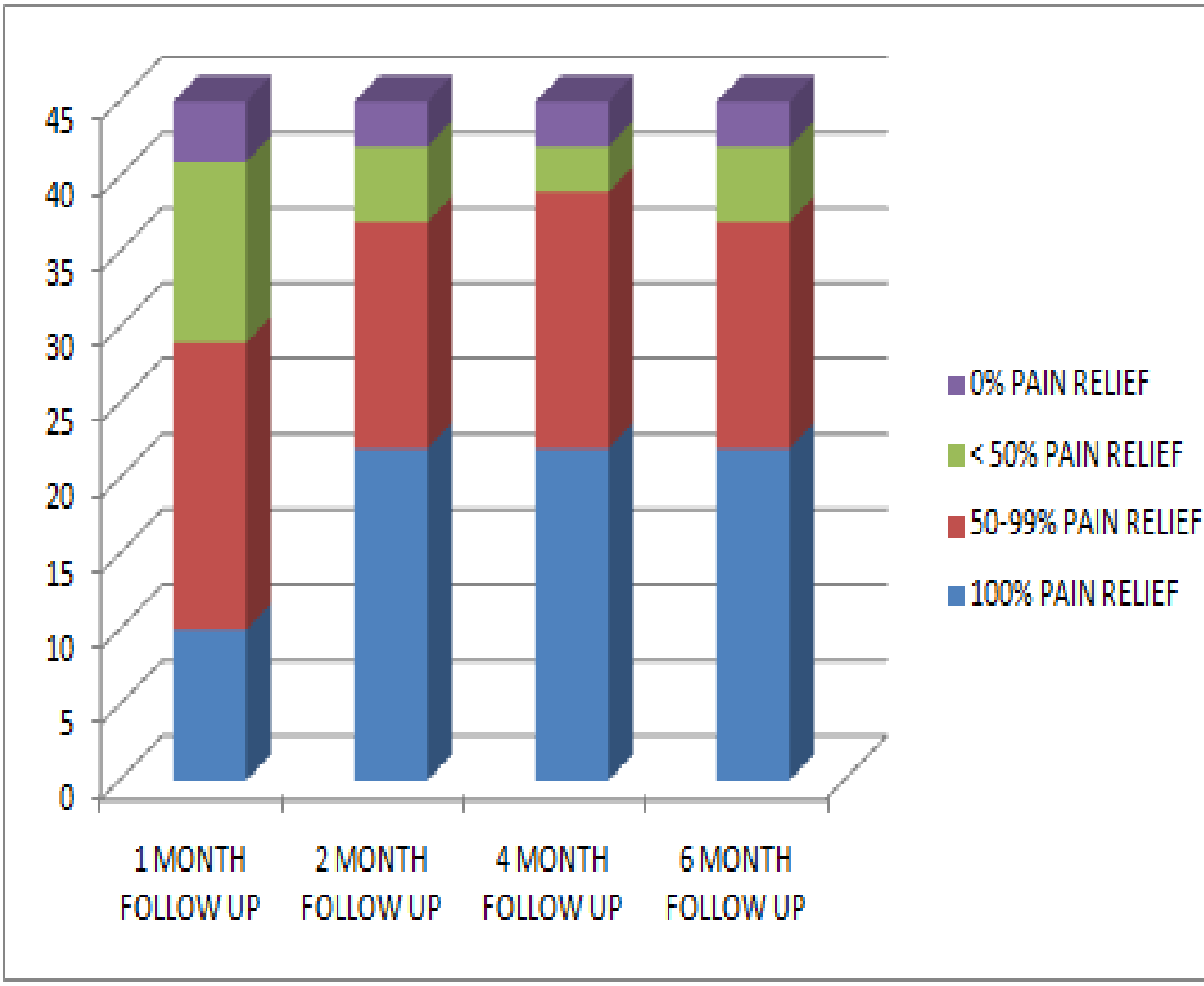


Block diagram no 1: percentage reduction of pain in total patients

Analyzing patients separately for plantar fasciitis and tennis elbow, patients with plantar fasciitis fared better (82 percent) compared to tennis elbow (68 percent). (Chart no 3 and 4)

	100% PAIN RELIEF	**50-99% PAIN RELIEF**	**LESS THAN 50% PAIN RELIEF**	**0% PAIN RELIEF**
1ST MONTH FOLLOW UP	**10(22.22%)**	**19(42.22%)**	**12(26.67%)**	**4(8.89%)**
2ND MONTH FOLLOW UP	**22(48.89%)**	**15(33.33%)**	**5(11.11%)**	**3(6.67%)**
4TH MONTH FOLLOW UP	**22(48.89%)**	**17(37.78%)**	**3(6.67%)**	**3(6.67%)**
6TH MONTH FOLLOW UP	**22(48.89%)**	**15(33.33%)**	**5(11.11%)**	**3(6.67%)**

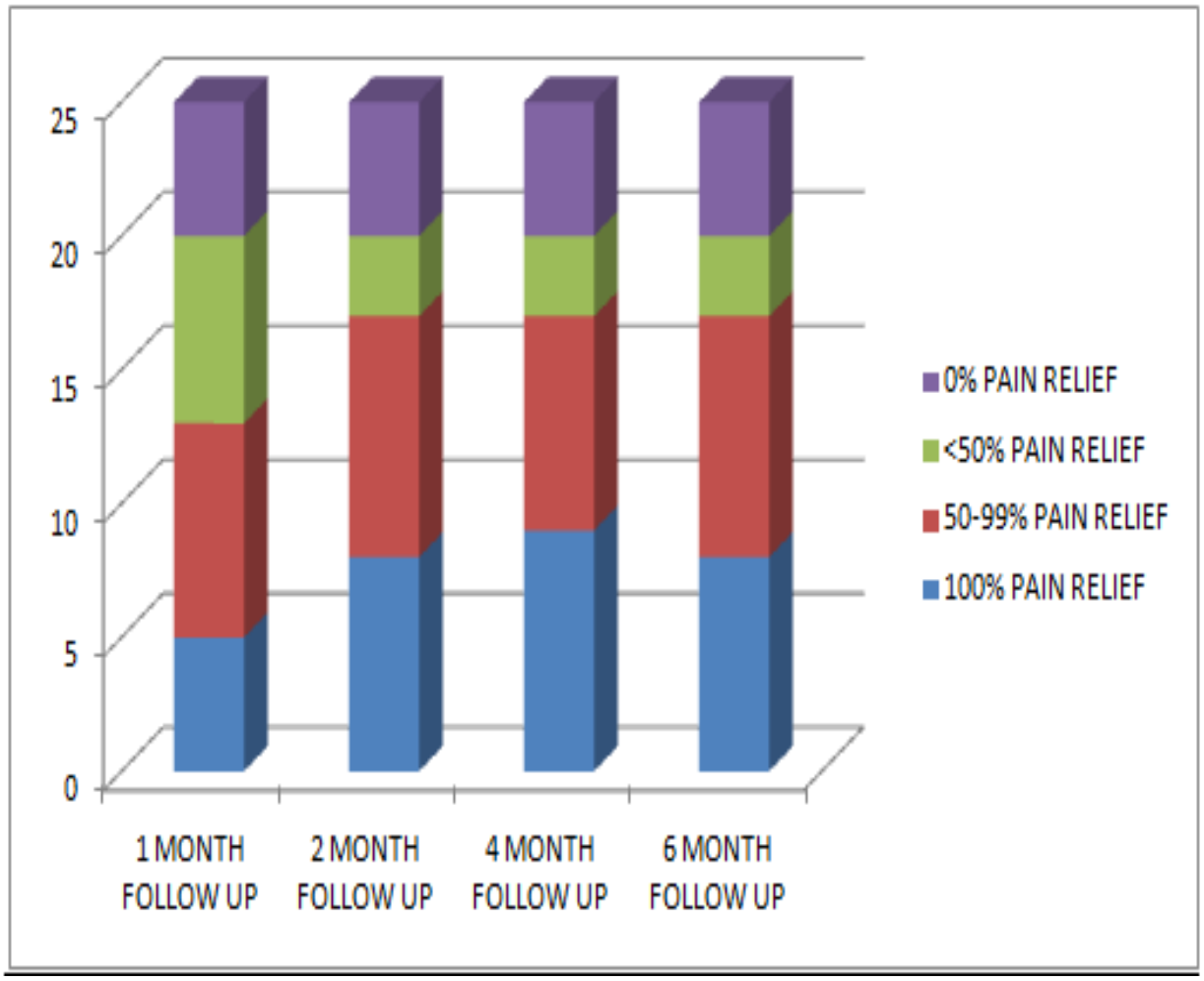
Chart no 3: percentage reduction of pain in plantar fasciitis patients



Block diagram no 2: percentage reduction of pain in plantar fasciitis patients

	100% PAIN RELIEF	50-99% PAIN RELIEF	LESS THAN 50% PAIN RELIEF	0% PAIN RELIEF
1ST MONTH FOLLOW UP	5(20%)	8(32%)	7(28%)	5(20%)
2ND MONTH FOLLOW UP	8(32%)	9(36%)	3(12%)	5(20%)
4TH MONTH FOLLOW UP	9(36%)	8(32%)	3(12%)	5(20%)
6TH MONTH FOLLOW UP	8(32%)	9(36%)	3(12%)	5(20%)

Chart no 4: percentage reduction of pain in tennis elbow patients



Block diagram no 3: percentage reduction of pain in tennis elbow patients

DURATION OF SYMPTOMS:

Out of total 70 patients 59 patients had symptoms of less than one year duration.

11 patients had pain for more than one year before coming here for treatment.

All patients had conservative treatment for at least three months (chart no 5).

	3-6 MONTHS	7-12 MONTHS	MORE THAN 1 YEAR
TOTAL PATIENTS(70)	**35**	**24**	**11**
PLANTAR FASCIITIS(45)	**24**	**18**	**3**
TENNIS ELBOW(25)	**11**	**6**	**8**

Chart no 5: Duration of symptoms

DURATION OF SYMPTOMS AND PAIN RELIEF:

Analysis was done based on the duration of symptoms and ultimate pain relief. 16 out of the 35 patients with pain of less than 6 months, 9 out of 24 patients with duration of symptoms between 6-12 months and 5 out of 11 with symptoms of greater than one year had complete relief of pain. 2 out of 35 patients with pain less than 6 months, 4 out of 24 patients with pain for 6-12 months, and 2 out of 11 with pain greater than 1 year duration had no improvement of symptoms at six months (chart no-6). Duration of symptoms had no significant correlation with the clinical outcome after injection.

	100% PAIN RELIEF	50-99% PAIN RELIEF	LESS THAN 50% PAIN RELIEF	0% PAIN RELIEF
3-6 MONTHS	16(22.86%)	13(18.57%)	4(5.71%)	2(2.86%)
7-12 MONTHS	9(12.86%)	9(12.86%)	2(2.86%)	4(5.71%)
MORE THAN 1 YEAR	5(7.14%)	2(2.86%)	2(2.86%)	2(2.86%)

Chart number 6: PAIN REDUCTION RELATED TO DURATION OF SYMPTOMS IN TOTAL PATIENTS

STATISTICAL ANALYSIS:

SPS software system was used to do statistical analysis by comparing the results of 1,2,4,6 months. P value for the test was taken as 0.05.

Group Statistics								
	Number of patients		Mean percentage reduction of pain		Std. Deviation		Std. Error Mean	
	Plantar fasciitis	Tennis elbow	Plantar fasciitis	Tennis elbow	Plantar fasciitis	Tennis elbow	Plantar fasciitis	Tennis elbow
1 month	45	25	57.6544	47.5000	33.18452	36.38205	4.94686	7.27641
2 month	45	25	75.6796	57.6108	31.88905	37.63747	4.75374	7.52749
4 month	45	25	77.4080	58.6108	30.10367	38.44225	4.48759	7.68845
6 month	45	25	75.8647	57.2776	32.22099	37.92296	4.80322	7.58459

Independent Samples Test					
	Equal variances assumed				
	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
1 month	.683	.411	1.185	68	.240
2 month	1.483	.227	2.129	68	.037
4 month	3.389	.070	2.264	68	.027
6 month	1.762	.189	2.170	68	.034

The mean pain score at 2nd, 4th and 6th month found to significantly equal but pain score at 1 month was not significantly equal.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	**1 month**	54.0279	70	34.44765	4.11728
	2 month	69.2264	70	34.88885	4.17002
Pair 2	**2 month**	69.2264	70	34.88885	4.17002
	4 month	70.6947	70	34.26667	4.09565
Pair 3	**4 month**	70.6947	70	34.26667	4.09565
	6 month	69.2264	70	35.25239	4.21347
Pair 4	**2 month**	69.2264	70	34.88885	4.17002
	6 month	69.2264	70	35.25239	4.21347

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	1 month & 2 month	70	.765	.000
Pair 2	2 month & 4 month	70	.983	.000

Paired Samples Test									
		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	1 month - 2 month	-15.1986	23.75019	2.83869	-20.8616	-9.5355	-5.354	69	.000
Pair 2	2 month - 4 month	-1.4683	6.39264	.76407	-2.9926	.0560	-1.922	69	.059
Pair 3	4 month - 6 month	1.4683	9.34823	1.11733	-.7607	3.6973	1.314	69	.193

Pair 4	**2 month - 6 month**	.0000	13.77992	1.64702	-3.2857	3.2857	.000	69	1.000

When comparing the significance of pain reduction it was found that there was significant pain reduction till two months and further the reduction was not significant. This indicates there was not much reduction of pain after 2nd month.

DISCUSSION:

Platelet contains biologically active substance for blood clotting, such as coagulation factors, adhesive proteins and protease inhibitors. Platelets were also known to release growth factors like TGF –beta 1, CGF, VEGF, and PDGF. These growth factors are released once the platelets were activated. These growth factors initiates the process of tissue healing by cellular proliferation and differentiation, chemo taxis, tissue debris removal, angiogenesis, and extra cellular matrix formation (5). These properties of tissue healing by platelets are used in treating degenerative enthasopathies like plantar fasciitis and tennis elbow by direct local injection of autologous platelet rich concentrate.

Various techniques have been described for the preparation of autologous platelet rich plasma. They differ in duration and speed of centrifugation. The containers used for platelet rich plasma preparation also differ to minimize the direct handling of blood. The volume of platelet rich plasma usually comes about 10 percent of the whole blood used. Alsousou et al used a gps system for preparation of PRP. The prp volume of about 5 ml was collected following 12 minutes of rotations at 3200 rpm (5). Augustus D et al used a double centrifugation method which separates blood first in to plasma and RBC. The

plasma formed was separated again in to platelet rich plasma and platelet poor plasma by second centrifugation (23). In this study Augustus D et al method of double centrifugation was used. By repeated trial and error method we standardized the procedure of preparation of platelet rich plasma.

Platelet rich plasma is also known as platelet rich concentrate, autologous platelet gel or platelet releasate (15).platelet rich plasma is defined as autologous blood with a concentration of platelets above the base line values. The platelet count in our samples ranged from two to six lakhs per cc. Hall m.p. et al described platelet rich plasma contains a two to eight fold increase in platelet concentration and 1-25 fold increase in growth factor concentration (14). According to Marx R E et al in an article “what is prp and what is not PRP?” described that at least 10 lakhs of platelet per ml in five ml of plasma, will be associated with enhancement of healing. Alsousou J et al in a review article described a concentration of five times the normal count as working definition of PRP (5).

Growth factor concentration can be assessed by ELISA. Concentration of growth factors also depends on the method of preparation of prp. Augustus et al found

that growth factors like HGF, IGF-1, and PDGF will be high in single centrifugation than in double centrifugation (23). Since the assay of growth factors was not cost effective we did not do assay of growth factors.

PRP can be divided in to low WBC PRP and high WBC PRP depending on WBC concentration. Augustus D et al found that WBC count is low in platelet poor plasma and high in platelet rich plasma (23).They found that there were no significant difference in WBC cell types in platelet poor plasma and platelet rich plasma (23). The concentration of WBC in prp was a subject of debate. Some authors recommended avoiding exposure of WBC to tissues so that inflammatory reaction may decrease. Bielecki T M et al support the WBC presence as it has antibacterial actions and increase in growth factor release (38).

Platelets in PRP get activated once they get released from circulation. Different techniques have been used by various authors for platelet activation. Kenneth s lee et al described that needle prick at the time of injection will induce bleeding which will provide the clotting factor thrombin need for activating platelets. Addition of substances like bovine thrombin, calcium chloride and type

1 collagen for activating platelets (18). In this study Kenneth s lee et al technique of needling was used for platelet activation (19).

Most of the authors used similar technique of infiltration for PRP treatment. Keith s Hetchman et al, Joost .c. Peerbooms et al, Ertugrul Aksahin et al, Ehab Mohammed selem Ragab et al, used similar technique. They palpated the point of maximum tenderness and injected by single skin portal and five to six penetrations in surrounding tissues. This technique was known as peppering technique. In this study we used same technique for injecting platelet rich plasma in plantar fasciitis and Tennis elbow patients.

This was a prospective trial by study design conducted on 70 patients which includes 45 patients with plantar fasciitis and 25 patients with tennis elbow. Both groups of patients were selected based on the inclusion criteria and exclusion criteria described. Patients having chronic inflammatory conditions like rheumatoid arthritis are excluded from the study. Assessment of progression was done based on numerical pain scoring system.

The following are some studies, investigated the efficacy of PRP on tennis elbow and plantar fasciitis. The studies on plantar Fasciitis were conducted by Joost c Peerbooms et al (22), Ehab Mohammed selem Ragab et al (1) , Ertugrul

Aksahin et al (2) etc. Joost c peerbooms et al done a randomized multicenter trial with a study population of 120 patients above eighteen years. They compared the results with steroid injection by randomly selecting patients for PRP and steroid injections. The outcome was measured based on pain and functional scores. Ertugrul Aksahin et al did a similar study by comparing the effect of PRP and steroid injection on plantar fasciitis. The study population was 60 with 30 each patients got PRP and steroid injections. Ehab Mohamed selem Ragab et al did a study on 25 plantar fasciitis patients by injecting PRP. The outcome was measured by comparing preinjection and post injection visual analog score and plantar fascia thickness by ultrasound (1). There was no control group in his study

Following are some studies conducted on tennis elbow patients 1. Christos Thanases et al by comparing PRP to whole blood for tennis elbow (14). 2. Samuel A Taylor et al on 100 tennis elbow patients compared between PRP and steroid injection (11). 3. Keith s Hetchman et al on 31 elbows which was not responded for conservative treatment by single PRP injection (13).

While comparing the results at 1,2,4,6 months follow up, it was found that patients got relief at one month. However the maximum relief of symptoms was at two months. The results obtained at two months sustained till the end of the

study except in two patients. One patient with tennis elbow and one patient with plantar fasciitis had recurrence of symptoms at four months. While considering the results in plantar fasciitis and tennis elbow patients separately it was found that results of plantar fasciitis were better than tennis elbow. 82percent of plantar fasciitis patients and 68 percent of tennis elbow patients had more than 50 percent of pain relief at six months. No patients had repeat injections. The above results were comparable with Ertugral Aksahin et al and Christos Thanases et al study (2, 14). The study of Christos Thanasas et al in tennis elbow the mean injection score was reduced from 6.1 to 2.35 at the end of 6 weeks, at 3 months 1.9 and 6 months 1.7. In a study by Ertugral Aksahin et al on plantar fasciitis patients the mean pain score was reduced from 7.33 to 5.6 at 3 weeks and 3.9 at 6 months.

The difference between 1, 2, 4 and 6 months pain reduction were tested for significance by paired T – test using SPS system and found that there was no significant difference in pain reduction between 2 months and 4 months, 2 months and 6 months, 4 months and 6 months scores. But there was significant difference in pain score in 1 and 2 months. By testing independent samples T-test using equal variances assumed found that 2 months, 4 months and 6 months pain reduction was significantly equal in all groups.

Duration of symptoms suggests the chronic nature of disease. In this study only 11 out of 70 patients had symptoms more than one year duration. 7 patients out of 11 had more than fifty percent pain relief compared to 18 patients out of 59 with less than one year duration. No studies are available to compare the chronicity of disease and outcome after PRP injection.

LIMITATIONS OF THE STUDY

1. No control group was used and hence available for comparison in this study.

2. Assessment was subjective based on patient's perception of pain and no other objective assessment was done.

SUMMARY

Plantar fasciitis and tennis elbow are two diseases having similar pathology and both are considered as degenerative tendinopathies. Repeated micro trauma is the major etiology of these two diseases. Autologous platelet rich plasma injections are becoming more popular in the treatment of enthasopathies like plantar fasciitis and tennis elbow. The growth factors in platelet rich plasma cause tissue healing. We conducted a study by intralesional autologous platelet rich plasma injections in chronic plantar fasciitis and tennis elbow patients. This was a prospective study conducted on total 70 patients, out of which 45 patients had plantar fasciitis and 25 patients had tennis elbow. Patients were selected based on the inclusion and exclusion criteria described. All the patients had similar form of treatment given that is single intralesional autologous PRP injection by peppering technique. Platelet rich plasma was prepared by a double centrifugation method initially at 1500 rotations per minute for 3 minutes and later at 2500 rotations per minute for 3 minutes. 2ml of PRP was obtained from 20ml of blood. This PRP was analyzed for cell count. The initial and 1,2,4,6 month's numerical pain score was recorded and analyzed. It was found that 77 percent of patients had significant relief of pain at two months which continued till the end of study. Pain relief in plantar fasciitis and tennis elbow patients were

analyzed separately and found 82 percent of plantar fasciitis patients and 68 percent of tennis elbow patients had significant pain relief at two months and it continued till the end of study. Duration of symptoms to pain relief were analyzed and found no correlation. Finally it was concluded that intralesional autologous platelet rich plasma injection was safe and useful in the treatment of chronic plantar fasciitis and tennis elbow and plantar fasciitis benefit better than tennis elbow with maximum benefit observed at 2 months.

CONCLUSION

Autologous PRP injection is a safe and useful modality of treatment in the treatment of chronic plantar fasciitis and tennis elbow.

The response of patients with plantar fasciitis was significantly better than tennis elbow to platelet rich plasma injection.

Maximum benefit after PRP injection was observed at 2 months and sustained for at least 6 months.

More trails are required to optimize the technique for separating platelet rich plasma.

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CONSENT FORM

Participant's name:

Address:

Title of the study:

EFFICACY OF AUTOLOGOUS PLATELET RICH PLASMA INJECTIONS IN PLANTAR FASCIITIS AND TENNIS ELBOW

The details of the study have been explained to me in my own language. I confirm that I have understood the above study and had the opportunity to ask questions. I understood that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without the medical care that will normally be provided by the hospital. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s). I fully consent to my participation in the above study.

Signature of participant: **date:**

Signature of witness 1: **date:**

Signature of witness 2: **date:**

For any study related queries, you are free to contact:

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Psgimsr

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Guide: **Dr. B K Dinakar Rai**

Professor and head

Department of orthopedics

Psgimsr

Coimbatore-641004

Phone: 9894140052

Place: **signature of investigator**

Date:

PSG INSTITUTE OF MEDICAL SCIENCE AND RESEARCH-COIMBATORE

EFFECACY OF AUTOLOGOUS PLATELET RICH PLASMA INJECTIONS IN PLANTAR FASCIITIS AND TENNIS ELBOW

Investigator: Dr. Parvees.ch

Guide: Dr. B K Dinakar Rai

PATIENT DETAILS:

Name:

Age:

Sex:

Hospital number:

Disease:

Duration of symptoms:

Pain score:

Date of injection:

Follow ups:

1st month	2nd month	4th month	6th month

MASTER CHART

SL NO:	NAME	AGE	SEX	DISEASE	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
1	VIJAYA LAKSHMI	42	F	PLANTAR FASCIITIS	7 MONTHS	9	0	0	0	0
2	PALANISAMY	41	M	TENNIS ELBOW	6 MONTHS	8	4	3	3	3
3	SUBRAMANIAM	45	M	PLANATR FASCIITIS	4 MONTHS	9	8	8	8	8
4	SUSEELA DEVI	54	F	PLANATR FASCIITIS	5 MONTHS	9	0	0	0	0
5	SELVAN	33	M	PLANTAR FASCIITIS	6 MONTHS	8	2	0	0	0
6	SAVITHRI	43	F	PLANTAR FASCIITIS	3 MONTHS	9	4	3	3	3
7	JOTHI	35	F	PLANATTR FASCIITIS	1 YEAR	9	6	4	4	4
8	VALLIAMMAL	50	F	PLANTAR FASCIITIS	3 MONTHS	9	0	0	0	0
9	BHARATHI	39	F	PLANTAR FASCIITIS	5 MONTHS	8	8	8	8	8
10	RAMANI	33	F	PLANTAR	1 YEAR	9	6	0	0	0

				FASCIITIS						
11	MARIYA ANTHUVAN	43	M	TENNIS ELBOW	8 MONTHS	8	8	8	8	8
12	SUMATHI	34	F	TENNIS ELBOW	1 ½ YEAR	8	6	2	0	0
13	GANESAN	68	M	TENNIS ELBOW	6 MONTHS	9	0	0	0	0
14	GOKILA	50	F	PLANTAR FASCIITIS	3 MONTHS	8	6	4	4	6
15	VIJAYALAKSHMI.R	50	F	PLANTAR FASCIITIS	1 YEAR	9	0	0	0	0
16	SENBAGAVALLI	30	F	PLANTAR FASCIITIS	1 YEAR	9	2	0	2	8
17	SEMBAGAM	42	F	TENNIS ELBOW	1 YEAR	8	8	8	8	8
18	UMADEVI	37	F	TENNIS ELBOW	3 MONTHS	9	2	0	0	0
19	MAHESWARI	38	F	TENNIS ELBOW	1 YEAR	8	8	8	8	8
20	PANKAJAM	33	F	TENNIS ELBOW	1 ½ YEAR	8	2	0	0	0
21	PADMAVATHI	54	F	PLANTAR FASCIITIS	8 MONTHS	9	1	0	0	0
22	RASATHI	47	F	PLANTAR FASCIITIS	3 MONTHS	8	0	0	0	0
23	KALIYAPPAN	59	M	PLANTAR FASCIITIS	3 MONTHS	9	0	0	0	0
24	MANJULA	25	F	PLANTAR FASCIITIS	6 MONTHS	9	2	0	0	0
25	VENKATA PRIYA	35	M	TENNIS ELBOW	5 MONTHS	8	0	0	0	0
26	ANNIEMMA	50	F	TENNIS	2 YEARS	9	7	5	5	6

				ELBOW						
27	DHANABAGYAM	46	F	PLANTAR FASCIITIS	3 MONTHS	8	6	4	4	4
28	SENTHIL KUMAR	33	M	PLANTAR FASCIITIS	3 MONTHS	9	0	8	6	6
29	SAVITHRI.M	43	F	PLANTAR FASCIITIS	1 ½ YEARS	8	3	0	0	0
30	RAVI	45	M	TENNIS ELBOW	1 YEAR	8	6	3	3	3
31	THIRUNAVAKARASU	56	M	TENNIS ELBOW	8 MONTHS	8	6	4	4	4
32	GOVINDAMAL	51	F	PLANTAR FASCIITIS	6 MONTHS	9	9	0	0	0
33	LAKSHMI	40	F	PLANTAR FASCIITIS	5 MONTHS	9	8	6	5	5
34	RAJALAKSHMI	41	F	TENNIS ELBOW	4 MONTHS	9	3	2	2	2
35	THANGAVEL	50	M	TENNIS ELBOW	6 MONTHS	9	0	0	0	0
36	PARASURAMAN	46	M	PLANTAR FASCIITIS	3 MONTHS	9	0	0	0	0
37	DARANIDHARAN	26	M	PLANTAR FASCIITIS	8 MONTHS	9	8	6	4	2
38	MYLSAMY	37	M	TENNIS ELBOW	6 MONTHS	9	0	0	0	2
39	SHANTHI	40	F	TENNIS ELBOW	3 MONTHS	9	6	6	6	6
40	DEVAKI	42	F	PLANTAR FASCIITIS	4 MONTHS	9	2	1	0	0
41	NARAYANI	61	F	PLANTAR	6 MONTHS	9	0	0	0	0

				FASCIITIS						
42	GANESHA MOORTHY	63	M	PLANTAR FASCIITIS	8 MONTHS	9	0	0	0	0
43	PRAMEELA	46	F	PLANTAR FASCIITIS	1 YEAR	9	9	9	9	9
44	POONGODI	42	F	TENNIS ELBOW	1 ½ YEARS	9	9	9	9	9
45	VENKATA SAMY	53	M	PLANTAR FASCIITIS	1 ½ YEARS	9	2	0	0	0
46	SARASWATHI	39	F	TENNIS ELBOW	8 MONTHS	8	6	4	4	4
47	RANI	41	F	PLANTAR FASCIITIS	3 MONTHS	9	9	9	9	9
48	SINDHU	36	F	TENNIS ELBOW	6 MONTHS	9	0	0	0	0
49	KAVITHA	39	F	PLANTAR FASCIITIS	8 MONTHS	8	4	1	1	1
50	RUKMANI	48	F	TENNIS ELBOW	1 ½ YEARS	9	9	9	9	9
51	USHA DEVI	52	F	PLANTAR FASCIITIS	6 MONTHS	9	7	3	2	2
52	PADMAVATHI	58	F	TENNIS ELBOW	1 ½ YEARS	9	7	7	7	7
53	PIUS SAVARIMUTHU	43	M	PLANTAR FASCIITIS	8 MONTHS	9	5	2	0	0
54	MARIAMMAL	67	F	PLANTAR FASCIITIS	5 MONTHS	8	3	0	0	0
55	MUTHUSAMY	59	M	TENNIS ELBOW	6 MONTHS	8	4	4	4	4
56	LATHA	45	F	PLANTA	3	9	4	0	0	0

				R FASCIITIS	MONTHS					
57	JAYALAKSHMI	61	F	PLANTAR FASCIITIS	8 MONTHS	8	3	3	3	3
58	BHAMA	38	F	PLANTAR FASCIITIS	9 MONTHS	8	4	0	0	5
59	SAROJINI	62	F	PLANTAR FASCIITIS	6 MONTHS	9	3	3	3	3
60	PARVATHY	43	F	PLANTAR FASCIITIS	9 MONTHS	8	2	0	0	0
61	GOMADHI	46	F	PLANTAR FASCIITIS	3 MONTHS	8	3	2	2	2
62	SOUNDARAJ	39	M	TENNIS ELBOW	6 MONTHS	8	4	4	4	4
63	KALAMANI	38	F	PLANTAR FASCIITIS	5 MONTHS	9	7	3	3	3
64	MANOHARI	47	F	PLANTAR FASCIITIS	8 MONTHS	8	2	2	2	2
65	PANKAJAM	53	F	TENNIS ELBOW	1 ½ YEARS	9	2	0	0	0
66	VIJAYALAKSHMI. P	58	F	PLANTAR FASCIITIS	1 YEAR	8	4	0	0	0
67	KUTTIYAMMAL	64	F	TENNIS ELBOW	2 YEARS	8	3	3	3	3
68	VIJAYA.P	50	F	PLANTAR FASCIITIS	8 MONTHS	9	4	3	3	3
69	VARUNA	45	F	PLANTAR	9 MONTHS	9	7	3	2	2

				FASCIITIS						
70	SUSHA	52	F	PLANTAR FASCIITIs	3 MONTHS	9	3	3	3	3